



TERMS OF REFERENCE

Consultancy for GPU/HPC-Based Water and Energy Budget Modelling

Issued by	WACREN — West and Central African Research and Education Network
Reference No.	WACREN/CONSULT/2026
Date of Issue	August 10, 2026
Submission Deadline	September 21, 2026 — 17:00 UTC
Project Duration	24 months from contract commencement
Duty Station	Remote / Hybrid — with field missions as required



1. Background and Context

The West and Central African Research and Education Network (WACREN) is the Regional Research and Education Network (RREN) serving the West and Central African sub-regions. Through the AfricaConnect4 (AC4) programme, WACREN has invested in advanced cloud and high-performance computing (HPC) infrastructure, including Graphics Processing Units (GPUs), to serve the research and education communities across the region.

A critical application domain for these computational assets is the management of water and energy resources, particularly in the context of accelerating climate change impacts on major river basins. The Volta River Basin, shared among six countries — Ghana, Burkina Faso, Togo, Benin, Côte d'Ivoire, and Mali — is central to West Africa's hydroelectric energy supply, with the Akosombo and Bui Power Authorities constituting the backbone of Ghana's electricity generation capacity.

Current water and energy budget models for the basin rely predominantly on CPU-based processing, which limits temporal resolution, forecast lead times, and the ability to run ensemble simulations. The transition to GPU/HPC-accelerated modelling presents a transformative opportunity to improve forecast accuracy, support hydroelectric dispatch planning, and strengthen climate resilience strategies for critical national infrastructure.

To realise this opportunity, WACREN is calling for a post-master's or doctoral fellows to lead the implementation of a GPU/HPC-based model to analyse the Water and Energy Budget of the Volta River Basin, supporting hydroelectric energy management for Akosombo and Bui Power Authorities. The consultant(s) should have demonstrated expertise in hydrology, climate modelling, or related computational geosciences. This Terms of Reference (ToR) defines the scope, methodology expectations, deliverables, and administrative modalities for the engagement.

2. Objectives of the Consultancy

The overall objective of this consultancy is to implement a GPU/HPC-accelerated water and energy budget model for the Volta River Basin that supports improved hydroelectric energy management for the Akosombo and Bui Power Authorities. The specific objectives are:

1. Design and deploy a GPU/HPC-enabled hydrological and energy budget modelling framework optimised for the Volta River Basin.
2. Assess and benchmark GPU-accelerated performance against existing CPU-based modelling approaches, quantifying improvements in computational speed, spatial resolution, and forecast skill.
3. Generate seasonal and sub-seasonal water and energy budget forecasts to support operational decision-making at Akosombo and Bui Power Authorities.
4. Develop capacity within WACREN-affiliated institutions by training researchers and IT staff in GPU/HPC-based hydrological modelling tools and workflows.



5. Produce a replicable Soil and Water Assessment Tool (SWAT+) modelling framework that can be extended to other major river basins within the WACREN region.

3. Scope of Work

The Consultancy Team shall be responsible for the following activities, organised across four thematic work packages.

Work Package 1: Baseline Assessment and Data Mobilisation

The team shall conduct a comprehensive review of existing CPU-based hydrological and energy budget models applied to the Volta River Basin, including model architectures, input data sources, and known performance limitations.

Specific tasks include:

- Inventory and appraisal of existing hydro-meteorological datasets (discharge, precipitation, evapotranspiration, land use/land cover, digital elevation models) from national and international sources, including EUMETSAT and national meteorological agencies.
- Assessment of WACREN's cloud and GPU/HPC infrastructure readiness for model deployment, including storage architecture, data pipeline design, and network throughput requirements.
- Gap analysis of data availability and quality, with a remediation plan including alternative data sources and bias correction strategies.
- Stakeholder consultation with the Akosombo Power Authority, Bui Power Authority, the Volta River Authority (VRA), and relevant national meteorological services to align model outputs with operational end-user needs.

Work Package 2: GPU/HPC Model Design and Implementation

The team shall design, configure, and implement a GPU/HPC-accelerated water and energy budget model. This work package constitutes the core technical deliverable of the consultancy. Tasks include:

- Selection, configuration, calibration and validation of the Soil and Water Assessment Tool (SWAT+) for the Volta River Basin, including migration and optimisation for GPU/HPC deployment. Where an alternative modelling framework is proposed, the Consultant shall provide clear technical justification demonstrating equal or superior suitability for basin-scale water and energy budget modelling.
- Configuration of the selected model(s) for the Volta River Basin domain, including parameterisation, boundary conditions, and forcing data integration.
- Migration and optimisation of the model codebase for GPU/HPC execution on WACREN's cloud infrastructure, including parallelisation, memory management, and batch processing routines.
- Integration with WACREN's Science DMZ architecture to ensure efficient data movement for large ensemble simulations and output archiving.



- Performance benchmarking against CPU-based reference runs, documenting speed-up factors, forecast skill scores (e.g., Nash-Sutcliffe Efficiency, KGE, RMSE), and resolution gains.

Work Package 3: Forecasting Products and Stakeholder Outputs

The team shall develop operational forecasting products and translate model outputs into decision-relevant formats for the Power Authorities and other end-users. Tasks include:

- Generation of seasonal (3-month) and sub-seasonal (2–6 week) water and energy budget forecasts for the Akosombo and Bui reservoir catchments, including probabilistic ensemble outputs.
- Development of a streamlined forecast dissemination workflow linking WACREN's HPC environment to end-user dashboards or reporting systems at the Power Authorities.
- Design of at least two stakeholder-facing output products (e.g., inflow forecast bulletins, hydropower energy potential summaries) co-developed with Power Authority representatives.
- Uncertainty quantification and communication protocols appropriate for operational hydroelectric planning contexts.

Work Package 4: Capacity Building and Knowledge Transfer

Sustainable impact requires that the modelling framework and associated expertise are institutionalised within WACREN and its member institutions. Tasks include:

- Delivery of at least one in person training and two virtual workshops (per year) on GPU/HPC-based hydrological modelling, targeting researchers and IT professionals from WACREN member universities and national agencies.
- Development of a technical training curriculum and accompanying practical exercises suitable for embedding within postgraduate research programmes.
- Preparation of comprehensive technical documentation, including model configuration guides, data pipeline documentation, and user manuals for the forecast dissemination system.
- Preparation of a replication guide for extending the framework to at least one additional river basin within the WACREN region.

4. Deliverables and Timeline

The consultant/consultancy team shall produce the following deliverables within the 24-month project period. The timeline is indicative and will be confirmed during the inception phase.



No.	Deliverable	Timeline
1	Inception Report — workplan, data inventory, infrastructure assessment, and stakeholder consultation summary	M1–M2
2	Baseline Assessment Report — existing model review, gap analysis, and data mobilisation plan	M3
3	Model Design and Architecture Document — selected framework justification, configuration plan, and GPU/HPC deployment strategy	M4–M5
4	Operational Model Deployment — configured and benchmarked GPU/HPC model running on WACREN cloud infrastructure	M6–M12
5	Benchmarking Report — performance comparison with CPU baseline, validation statistics, and uncertainty analysis	M13
6	Seasonal Forecast Demonstration Package — six months of retrospective forecast runs and two stakeholder output products	M14–M18
7	Training Workshop 1 — workshop delivery report, training curriculum, and practical exercises. Two additional virtual workshops should be considered. <i>PS. One in person workshop and two virtual trainings each year.</i>	M16
8	Replication Guide — technical guide for basin extension to at least one additional WACREN-region river basin	M21–M22
9	Final Technical Report — comprehensive documentation of all work packages, findings, and recommendations	M23–M24
10	Technical Documentation Package — model configuration guides, data pipeline documentation, and user manuals	M24
11	Soil and Water Assessment Tool (SWAT+) model deployed for large-scale water and energy simulations	M24

5. Proposal Requirements

Interested consultant or academic teams are invited to submit a Technical and Financial Proposal comprising the following components.



5.1 Technical Proposal

- ✓ Cover Letter — signed by the Lead Consultant, where applicable, confirming the team composition, institutional affiliation, and commitment to the ToR.
- ✓ Team Profiles — detailed CVs for the Lead Consultant and other team members explicitly addressing the qualification criteria set out in Section 4.
- ✓ Technical Approach — a narrative description (maximum 15 pages) of the proposed methodology for each work package, including details of the selected modelling framework and GPU/HPC deployment strategy.
- ✓ Work Plan — a Gantt chart or equivalent visual work plan covering all deliverables and milestones over the 24-month project period.
- ✓ Risk Register — identification of key project risks (technical, data, institutional) and proposed mitigation measures.
- ✓ At least two references or letters of support from institutions with which the Lead Consultant has engaged on comparable applied research projects.

5.2 Cost and Financial Proposal

Total budget: Up to €30,000, with €15,000 as maximum spend per year (VAT and all applicable taxes inclusive).
The financial proposal should include:

- ✓ A detailed budget broken down covering professional fees, and all other related expenses. The budget must be denominated in EUR.
- ✓ Consultant-related costs (including travel/accommodation for the workshop). WACREN will cover for workshop staging and participant costs. The workshop may be organized in any of the WACREN member countries, across the various regions, depending on suitability and logistical considerations.

5.3 Submission Instructions

- Proposals must be submitted electronically to pmo@wacren.net by September 21, 2026 at 17:00 UTC.
- The subject line of the submission email must read: "WACREN/CONSULT/2026 — [Institution Name]".
- Both the Technical and Financial Proposals must be submitted as separate PDF documents.

6. Eligibility Criteria

- ✓ Experts holding relevant PhD or Master's qualifications in Hydrology, Water Resources Engineering, Climate Science, Environmental Engineering, Computational Geoscience, Data Science, Remote Sensing, Environmental Modelling, Physical Geography, or closely related disciplines.



- ✓ A minimum of ten (10) years of post-doctoral research or academic experience, with a demonstrated record of publications in peer-reviewed international journals and experience leading multidisciplinary research programmes.
- ✓ Demonstrate proven experience in the design, calibration, validation, and application of river basin-scale hydrological and climate models, preferably within tropical or sub-Saharan African environments.
- ✓ Demonstrable expertise in GPU/HPC-enabled scientific computing, including experience with hydrological or climate modelling platforms such as SWAT+, WRF-Hydro, VIC, or equivalent, together with parallel computing and model optimisation techniques.
- ✓ Demonstrate proficiency in scientific programming and data analysis using tools such as Python, R, Fortran, C/C++, or equivalent, including experience with large geospatial, remote sensing, and hydro-meteorological datasets.

7. Dates and Timelines

Activity	Deadline
Invitation to Submit Proposals	August 10, 2026
Submission of final enquiries from vendors	August 26, 2026
Deadline for Submission of Proposals	September 21, 2026
Evaluation of Submitted Proposals	October 12, 2026
Intent to Award Agreement(s)	October 19, 2026
Contract Production and Finalisation	October 30, 2026
Start of Service Delivery	November 2026

WACREN reserves the right to amend this Terms of Reference, cancel the call, or decline to enter into a contract with any applicant, without obligation to provide justification. WACREN is committed to fair, transparent, and merit-based selection of consultants.